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THE EFFECTS OF A CLOTH WRAP IN STABILIZATION OF THE ANKLE

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This study aimed to examine the effects of the cloth wrap in ankle stabilization, since there is limited research of cloth wrap ankle stabilization. Twenty subjects (13 female, 7 male) were utilized in this study. Three conditions were performed on each ankle (Baseline, Wrapped, and Unwrapped). Results showed the only significant difference ($p<0.01$) found were the main effects for condition (Baseline vs. Wrapped, vs. Unwrapped). A significant interaction of condition by gender was also found ($p=0.034$). None of the other interactions were significant ($p>0.05$). It was concluded that the cloth wrap may have decreased the subject's proprioception. Females also stabilized out faster than males, possibly due to a lower center of gravity (COG).

KEYWORDS: stability, force platform, ankle sprain, center of gravity (COG).

INTRODUCTION: Ankle sprains are one of the most common injuries in athletics, representing from 38-50% of total sport injuries (Abián-Vicén 2008**)**. Despite the high prevalence of ankle injuries, controversy still exists on the best way to prevent this common injury (Mickel et al. 2006). The most common argument exists in whether to utilize prophylactic taping techniques or bracing. Both have the benefits of preventing plantar flexion and inversion, the common mechanism of injury in ankle sprains (Mickel et al 2006). However, taping especially has its downfalls. Taping procedures, regardless of the technique, have been known for loosening with physical activity (Mickel et al 2006, Nigg et al 2000). The cost-effectiveness of tape has also been scrutinized (Abian-Vicen 2008, Childs 2007).

The research on ankle bracing and taping techniques and their effects on preventing ankle sprains is plentiful; however, little research has been conducted on the effectiveness of a cloth ankle wrap in stabilizing the ankle. Because balance is such an important factor in all sports, whether in dynamic or static movement, this study utilized balance testing to determine the effectiveness of a cloth wrap in stabilizing the ankle joint. It is important to note that with dynamic balance comes the increased risk of injury. Upper body posture and stability directly affect the lower body due to the kinetic chain. Furthermore, to protect internal structures such as ligaments and cartilage from injury, a lower limb needs to be stabilized when loaded (Ackland et al 2009). Failure of muscles or ligaments to control joint posture results in excessive loading causing considerable motion between the two articulating bones of the joint, consequently placing great strain on the stabilizing structures (Ackland et al 2009). The purpose of this experiment was to examine the effect a cloth ankle wrap has on ankle stabilization while performing a static balance test.

METHOD: Twenty college students were recruited for this study (age: 21.5 ± 1.5 years), 13 female, 7 male. Ten subjects had previously sustained ankle injury and ten subjects had not. Subjects were asked to fill out a survey and a PAR-Q form before participating in the study. Written informed consent was provided by all twenty participants for the study which was approved by the University Institutional Review Board (Human Subjects Proposal Number: HS09-315).

Subjects' weight and height were measured and recorded (height: 169.3 cm ± 9.2 cm; weight: 735.4 N ± 138.8 N). The subjects took off their shoes and the balance for both ankles was analyzed using a force platform (AMTI Model OR6-5; Watertown, MA). Three conditions were performed for each ankle: Baseline (B), Wrapped (W), and Unwrapped (U), with B condition

performed first. From then on, the order of the conditions and sequence of the right or left ankle were randomized with a coin flip. The force platform was zeroed in the loaded state and the subjects placed the determined foot in the center of the platform and balanced for twenty seconds. The W and U conditions were performed while standing on a dyna-disc (Exertools, Rohnert Park, CA) to create perturbations (Figure 1). The W trials utilized the cloth ankle wrap for stabilization. The subjects sat on a table, extending their leg and positioning their foot at a 90° angle. The cloth was wrapped around the ankle using one heel lock and one figure eight (see Figure 2). For additional support, two heel locks and two figure eights were applied with adhesive tape over the cloth wrap (Prentice 2006). The U conditions did not utilize the cloth ankle wrap for stabilization. The subjects were allowed freedom to move their arms and opposite leg positioning as they chose. The right hip and knee started in approximately 5° of flexion and the ankle was in the neutral position. However, these positions fluctuated as necessary as the subjects tried to maintain their balance on the dyna-disc. All data were recorded using the AMTI NetForce software (version 2.1.1, Watertown, MA). Standard deviations of the subjects‘ movement as assessed by the vertical ground reaction forces were compared amongst each other as the dependent variable. Standard deviations were determined by comparing the movement of a subject over a period of twenty seconds. The standard deviations of these data was used as the means of comparision among conditions.Statistical analyses of the data were carried out in SPSS 17.0 (Chicago, IL). A Mixed ANOVA with Repeated Measures on condition (B, W, U) with non repeated measures on Gender, Injury Presence/Absence, and Side. The criterion for significance was set at an alpha level of $p \leq 0.05$.

Figure 1. Subject balancing on the dyna-disc.

Figure 2. Application of the cloth wrap.

RESULTS: Analysis of variance found no differences across the injuries, left and right sides, or genders. The only significant difference ($p < 0.001$) found were the main effects for condition (B vs. W vs. U). There were no significant differences across the conditions, genders, or right versus left foot ($p > 0.05$). In addition, a significant interaction of condition by gender was found ($p = 0.034$). None of the other interactions were significant ($p > 0.05$). The interaction of gender and condition and their values are illustrated in Figure 3.

DISCUSSION: The similarities during baseline conditions between males and females may be attributed to response time. Because there were no outside perturbation factors, the subjects were able to gain postural control and stability relatively quickly within the twenty-second time duration. However, when the dyna-disc was added to create perturbations in the U and W conditions, the differences in fluctuation were apparent between the male and female subjects. As shown in Figure 3, the female subjects had lower standard deviations over the U and W conditions (3.3667 and 3.8944 respectively) than the male subjects (4.7105 and 5.5744 respectively). A possible explanation might be the lower location of the center of gravity (COG) for women compared to men (Prentice, 2004). The lower height of their COG may give women

an advantage over men in balancing sports (Alexander 1997). With the lower COG, the female subjects may have been able to gain control over their movement quicker than their male counterparts.

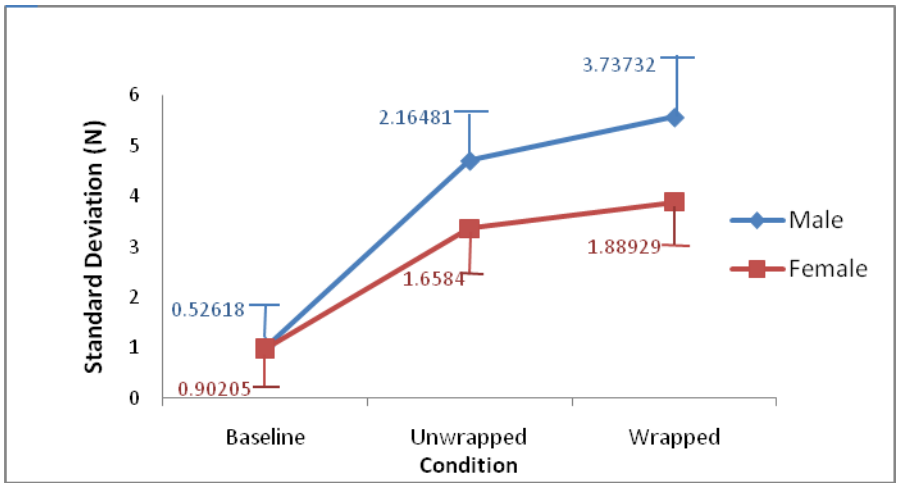

Figure 3. The standard deviation of male and female single-leg balancing over a twenty-second duration for conditions of Baseline, Wrapped, and Unwrapped.

Based upon the results of the main effects for condition (B vs. W vs. U), it is clear to see the W condition had higher standard deviation values than the U condition. Bracing and wraps have been shown to decrease proprioception (Nigg et all 2000), which may be why the W condition's standard deviations were higher for both subjects. The wrap only stabilizes the ankle joint, and because of the kinetic chain the subject's movement was more sporadic in the W condition as compared to the U condition.

The low subject number could the reasoning behind the non-significant findings for the right and left side, the presence or absence of injury, and the differences within genders. This study should be expanded to fully analyze these differences, in addition to gaining knowlege on the different stability maintenance techniques between male and female subjects.

CONCLUSION: There is still controversy existing about what method is best for prophylactic prevention of ankle sprains. This study was undertaken to observe the effectiveness of a cloth ankle wrap in stabilizing the ankle during a balance test. It was determined that the cloth ankle wrap was effective in stabilizing the ankle, in turn helping the subjects maintain their balance. In addition, results showed that women were able to maintain stability better in subsequent trials.

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